Report for 2002NJ8B: Salt Marsh Macrophyte Rhizosphere Effects on Sediment Microbial Community Catabolic Response Profiles

There are no reported publications resulting from this project.

Report Follows:

Problem and Research Objectives:

Due to their high assimilative capacities, salt marshes often act as a sink for introduced compounds. Retention of nutrient pollutants and metals in salt marsh sediments has been studied, but much less is known about the fate of organic pollutants or the value of estuarine marshes in promoting biotransformation of organic contaminants. This NJWRRI grant was requested to study the effect that different vegetation species have on salt marsh sediment microbial processes, specifically organic carbon mineralization rates. Measurement of microbial CO_2 production after the addition of various substrates results in a histogram profile for each vegetation type, and these catabolic response profiles (CRP) can then be compared. The purpose of this study is to adapt the CRP terrestrial techniques developed by Degens & Harris (1997) for use under anaerobic conditions, and to characterize the differences in *Spartina alterniflora* and *Phragmites australis* with respect to carbon mineralization.

Methodology

Sediment samples will be collected from brackish sites in the Hackensack Meadowlands (contaminated system) and the Glades wildlife preserve (non-contaminated system). Organic compounds from 8 main classes (amino acids, carbohydrates, carboxylic acids, alcohols, amides, amines, aromatics, polymers) typically found in root exudates will be added to the sediment samples. CO_2 evolution after a short (2-4 hour) bench top incubation period will produce a histogram that characterizes the ability of the *in situ* microbial community to mineralize the specific substrate. Brominated and chlorinated compounds will also be tested to determine if there are vegetation differences with respect to mineralization of halogenated organic compounds.

Principal Findings and Significance (Progress Report)

Initial tests indicate that this method can be used to differentiate wetland vegetation mineralization of organic carbon compounds.

Vegetation	CO2 Evolved/hr/g	Incubation Time	Substrate	Conc
Spartina	45.64	2 hours	a-ketoglutaric acid	200 mM
Phragmites	22.60	2 hours	a-ketoglutaric acid	200 mM
Mud	35.26	2 hours	a-ketoglutaric acid	200 mM

Concentrations: Due to the high levels of organic matter in wetland sediments, required concentrations of substrates may differ from those used by Degens & Harris (1997). Carboxylic acids tested in 100, 200, and 300 mM g^{-1} dry weight concentrations indicate that the 200 mM (used by Degens & Harris 1997) is also appropriate for wetland soils. Additional carboxylic acids are currently being tested using the 200 mM concentration. I am now in the process of testing the appropriate concentrations of other classes of substrates.

Incubation Timing: CO_2 evolution was tested after 1, 2, 3 and 4 hour bench top incubation times using carboxylic acid substrates. It was found that CO_2 production peaked after 2 hours in both vegetated and non-vegetated mud samples. However, after a 4 hour incubation period, CO_2 was found to decrease dramatically. I am in the process now of testing other substrate types for the correct incubation period.

It is possible that the decrease observed in CO_2 production is due to the CO_2 being used as a substrate for methanogenesis, resulting in CO_2 loss. I have decided to add the measurement of CH_4 to the experimental design. This means that the potential for methanogenesis, as well as carbon mineralization potential, will be measured for both vegetation types. I am currently in the process of developing a method to measure both CO_2 and CH_4 production using a single GC column and a single sample injection. The addition of methane measurement is an adaptation to the original Degens & Harris (1997) protocols that is important in the study of wetland soils.

Sediment Sampling Protocols: The first sampling protocol tried brought intact vegetation and sediment into the greenhouse, where samples were then extracted. It was found that this process resulted in sediment moisture loss as well as disruption of the rhizosphere zone. It was determined that natural sediment conditions will be less disturbed by taking cores in the field. These sediment cores will be taken from monospecific stands of each vegetation type and be immediately transported to the lab, where they will be maintained overnight at 15^0 C. Subsamples from the cores will be anaerobically transferred to 40 ml vials while in an anaerobic chamber, and anaerobically prepared sterile substrates will then be added.

Next Steps: It is anticipated that all initial adaptation tests will be completed during the summer 2003 field season. The experimental measurement of *Spartina* and *Phragmites* catabolic response profiles will be completed during Sept. 2003.